

THE AMERICAN JOURNAL  
OF  
OPHTHALMOLOGY.

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VOL. XXII.

APRIL, 1905.

No. 4.

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ORIGINAL ARTICLES.

METALLIC FOREIGN BODIES WITHIN THE EYE AND  
THEIR REMOVAL, BEING A CLINICAL ACCOUNT  
OF TWENTY-SIX OPERATIONS OF THIS  
CHARACTER.\*

ILLUSTRATED.

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IN recent years, especially since the utilization of the X-rays for the localization of foreign bodies within the eyeball, and the employment of large magnets, notably the Haab magnet, for their removal, this subject has assumed ever increasing interest. All surgeons are agreed as to the propriety of speedy removal of these bodies by means of magnets. There is still some difference of opinion whether it is better to draw the imbedded particle of metal from its position around the lens into the anterior chamber by means of a powerful magnet, especially the Haab magnet, and then extract it through a corneal incision, or whether, having ac-

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\*Presented at the Denver Meeting of Amer. Acad. of Ophth. and Oto-Laryng., Aug. 26, 1904.

curately localized it by means of the x-rays, it should be extracted through a scleral incision so placed that it shall be directly above the position indicated by the localization. In order to introduce a few remarks upon the subject, I append the condensed clinical histories of twenty-six cases in which the magnet has been employed, both with and without accurate localization for the removal of foreign bodies. They are as follows:

CASE 1.—James D., white, American, aged 28, was admitted to the Methodist Hospital on April 16, 1895, about one hour after he had received an injury of the left eyeball by a piece of steel which had broken from a chisel.

*Condition of the Eye.*—There was a cut 2 cm. in length along the line of the external rectus muscle; much vitreous had escaped and the eyeball was soft. The pupil was widely dilated, and only a dim view of the fundus was visible, the vitreous being obscured with blood-clot. V = counting fingers; visual field intact.

*Method of Localization.*—It was not possible to ascertain positively the presence of a foreign body by any of the usual methods then in vogue.

*Operation.*—The extension point of a Hirschberg magnet was introduced through the original wound and moved in all directions, without at first detecting a foreign body, and the eye dressed in the usual manner. Later, a small fragment of steel was detected just beyond the wound margin, where it had probably been drawn by the magnet and been rubbed off, when the instrument was withdrawn.

*Result.*—Healing was uneventful, and in two weeks the vision of the injured eye was 6/9. One month later hyalitis developed, and two weeks later detachment of the retina. The patient has not been seen since the last named date; but a second small fragment of steel was removed by another surgeon which was imbedded in the sclera. This case has been reported in the AMERICAN JOURNAL OF OPHTHALMOLOGY, Vol. XIII, 1896, p. 47. The small fragments of steel found near the wound are not, however, recorded in this account.

CASE 2.—F. McD., aged 19 years, single, machinist, consulted me on January 13, 1897, on account of an injury to

his left eye. Twenty-seven hours before his visit, while working around an engine and sledging upon some portion of the machinery, he was struck in the left eye with a chip of steel which flew from the piece of metal on which he was striking, the blow having been delivered in an upward direction. The foreign body entered through the sclera at the lower and inner quadrant of the eye. The patient was immediately taken to a neighboring hospital, where an electromagnet was twice introduced through the wound of entrance, without, however, removing the foreign body. The physician in charge of the operation stated that he thought he had moved the body, but that his magnet was not strong enough to withdraw it. The patient, by the advice of Dr. John Fay, then came to Philadelphia, with the hope of obtaining relief.

*Condition of the Eye.*—V. of L. E. = 5/60, with difficulty. The pupil was dilated widely, probably from the effects of atropin, the tension was diminished, the bulbar and tarsal conjunctivæ were flushed, and a small bead of vitreous protruded from a linear wound 3 mm. in length, situated  $1\frac{1}{2}$  centimeter from the corneal border, downward and inward, between the insertion of the internal and inferior rectus.

Ophthalmoscopic examination was unsatisfactory, on account of the haze in the vitreous, which prevented accurate observation of the details of the fundus. As far as could be made out, however, these included a vertically oval disc, enormously distended and tortuous veins, a patch of white tissue upon the nasal side of the disc, a fringe of hæmorrhage downward and outward from the papilla, and far forward in the upper portion of the eyeground an indistinct spot of dark color, vaguely resembling blood-clot, but very difficult to study. The lower half of the vitreous was filled with large blood-clots, through which could be seen dimly the rent in the coats of the eye.

*Method of Localization.*—Prior to the magnet operation, before the patient came under my care and prior to my own first operation, no method of localization other than that afforded by ophthalmoscopic examination was attempted. Before the third magnet operation was performed the foreign body was detected by the Roentgen rays and its position ap-

proximately determined. The X-ray examinations were made by Dr. Max J. Stern, of the Philadelphia Polyclinic, and indicated that the body was in the upper ciliary region.

*Operations.*—In the first magnet operation, the point of the instrument was introduced through the wound of entrance, and the result was negative. In the second operation the magnet was introduced through a wound in the upper ciliary region and was also unsuccessful. In the third operation the magnet was introduced through an incision, 8 mm. in length, in the upper ciliary region, midway between the insertion of the superior rectus and the corneal margin. The magnet used was according to the Hirschberg model, and the foreign body was immediately withdrawn. It weighed .0266 grams, or .41 grains, and was 4 mm. in length and 2 mm. in width.

*Result.*—The iridocyclitis, which was well established, rapidly subsided, and twelve days after the operation, the patient returned home with a vision of 6/12. There were some hyalitis and slight discoloration of the iris. Two months later vision was still 6/12, but the beginnings of proliferating iritis and the formation of connective tissue bands were visible.

*Remarks.*—It seems to me a very interesting circumstance that an eye can sustain such great traumatisms and still heal with useful vision. These traumatisms consisted of those produced originally by the entrance of the foreign body and its lodgment in the ciliary body; those caused by the immediate introduction, twice, of an electro-magnet; those caused at my first-electro-magnet operation, when the points were introduced both through the wound of entrance and through a new opening; and, finally, those produced by the successful electro-magnet extraction through a cut in the same position. Furthermore, the foreign body was imbedded in the ciliary body for twelve days, and had already caused enough irritation to start a cyclitis. This case has been fully reported in the American Journal of the Medical Sciences, May, 1897.

CASE 3.—A. G., white, male, American, aged 18, while striking with a hammer on a steel drill, received an injury of the left eye, a piece of the metal penetrating the globe. He

was referred to me by his physician, Dr. Alexander R. Craig, of Columbia, Pa.

*Condition of the Eye.*—The eye was examined within ten hours after the accident, and presented the following conditions: There was a small cut in the center of the cornea, about 4 mm. in length, from which was protruding a thin string of vitreous. A similar cut could be observed in the capsule of the lens, and the lens itself was entirely opaque. The iris was discolored. Vision equalled shadows.

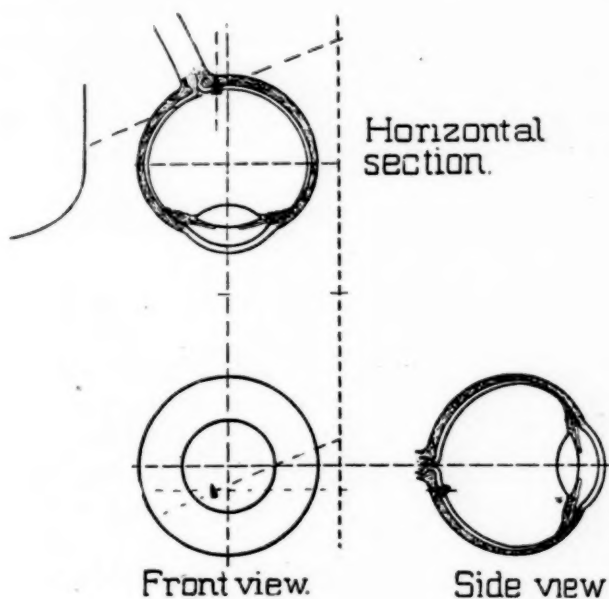


Fig. 1.

*Method of Localization.*—The patient was referred to Dr. Sweet for X-ray examination, who reported as follows: The piece of metal, which is small and about 3 mm. long and 1 mm. wide, is situated 1 mm. above the horizontal plane of the globe, 1.5 mm. to the nasal side and 23 mm. back of the center of the cornea. This would bring it in the retina in the neighborhood of the macula. Fig. 1.

*Operation.*—A scleral incision was made a little below the

lower margin of the external rectus downward and outward about a centimeter in length, and through this opening the broad, flat extension point of a Hirschberg magnet was introduced for 15 mm. The current was turned on, and on withdrawing the instrument, a triangular piece of steel was found attached to it, 2 mm. at its base, 1 1/2 mm. at its apex and 3 mm. in length. It weighed .0078 grams, or .12 grains.

*Result.*—The patient remained in the hospital one week, and was returned to his physician with the eye still slightly flushed, but in other respects in good condition. After his return home, he had an attack of pain with increased intra-ocular tension, which subsided under proper treatment and was evidently due to swelling of the crystalline lens. He was seen three months after the operation, his eye perfectly white and quiet, good light perception in all portions of the field and the ordinary appearance of traumatic cataract. The extraction of this would probably have restored vision, but the operation was declined.

CASE 4.—J. B., male, white, American, aged 40, while striking with a hammer on a spike received an injury of the left eye, and reported for treatment in the Jefferson College Hospital twenty-four hours later, having traveled a long distance on the railroad with a very imperfectly applied dressing.

*Condition of the Eye.*—There was a large cut in the sclera on the outer side, from which prolapsed vitreous and choroidal pigment were protruding. The eyeball was collapsed, the anterior chamber and, as far as could be ascertained, the vitreous filled with blood. Vision was doubtful light perception.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination January 5, 1901. The body is located at the equator and to the nasal side, that is, 12 mm. back of the center of the cornea and 12 mm. to the nasal side of the vertical plane. Fig. II.

*Operation.*—The broad extension point of a Hirschberg magnet was introduced through the original wound and immediately attracted to itself the piece of metal, which weighed .2284 grams, or 3.525 grains. The collapsed eyeball was

filled with physiological salt solution and the wound closed with interrupted sutures. The patient was placed in bed and the usual treatment of continued iced compresses, together with the internal administration of calomel, was instituted. There was no special reaction, and for a few days it appeared as if the wound might heal kindly. Indeed, it did close, but little by little the contracting exudates caused the eye to assume a quadrate form, and it never lost its tenderness and

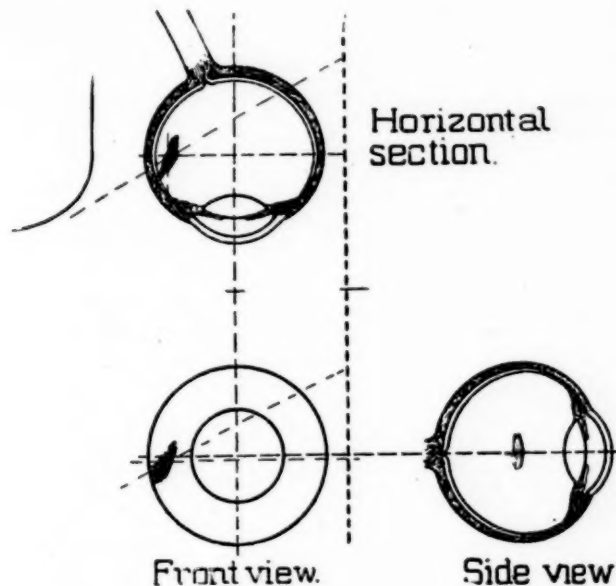


Fig. 2.

ciliary flush. Fearing that it might produce sympathetic trouble in the opposite eye, the shrinking globe was enucleated two months later.

*Pathological Examination of the Enucleated Eye.*—The eyeball was hardened in formalin and divided in the usual manner, half being mounted in glycerine-jelly and the other half submitted to microscopic examination. Fig. III. The eyeball is shrunken; the cornea shows new vessel formation and infiltration of the limbus. The iris presents evidence of

old iritis with destruction of the stroma cells, clumping of the pigment and fresh infiltration with mononuclear round cells, which are collected in round masses at the periphery and along the vessels. The vessels of the iris and ciliary body are hyperaemic and there is considerable extravasation of blood in the tissues, particularly in the meshes of the ciliary body and around Schlemm's canal. The lens shows advanced cataractous changes, especially in the posterior part, where the capsule is eroded. Behind there is a thick cyclitic mem-



Fig. 3.

Gross appearance of the diseased eyeball, Case IV.

brane which extends across the eyeball, which is well organized and has produced detachment of the ciliary body and anterior part of the choroid. It contains considerable pigment from old intraocular haemorrhage. In it is imbedded the retina, which is totally detached, passing forward from the optic nerve. The retina is in an advanced stage of degeneration and contains between its folds old blood pigment. The choroid is hyperaemic, thickened in places by organized exudate, and shows moderate fresh cellular infiltration. Anteriorly it is detached by the cyclitic membrane. The ciliary body is atrophic and the meshes widely pulled apart by blood extravasations. The optic nerve is also atrophic.

CASE 5.—J. C., male, white, American, aged 48, reported

at the Jefferson Medical College Hospital, with a chronic iridocyclitis and small corneal ulcer of the right eye. This eye had been injured eighteen years ago, but until a few weeks previously it had been quiescent.

*Condition of the Eye.*—There was well-marked chronic cyclitis, with occlusion of the pupil and cataract. In the lower part of the cornea there was a small ulcer. Vision was *nil*. The vision of the left eye was 20/XXX, and there was distinct sympathetic irritation.

*Method of Localization.*—Although there was no certainty that the eye contained a foreign body, the patient was referred to Dr. Sweet for skiagraphic examination, who reported as follow:

Examination January 28, 1900. Eye contains foreign body  $1.5 \times 1$  mm. which is situated 8 mm. back of the center of the cornea, 10 mm. below the horizontal plane, and 1 mm. to the temple side.

*Operation.*—The extension point of a Hirschberg magnet was introduced through a scleral incision over the region in which the skiagram indicated that the body was situated, and it was immediately drawn to the lips of the wound. The condition of the eye was such, however, as well as that of the opposite eye, that an immediate enucleation was considered advisable, and it was performed. The signs of sympathetic irritation in the opposite eye subsided almost at once. The foreign body was 1.5 mm. long and 1 mm. thick.

*Remarks.*—This case furnishes a good example of the accuracy of Knapp's statement that foreign bodies may be tolerated for long periods of time in the eye, but can never be trusted, unless they are small and the accompanying changes trifling; otherwise they are liable to cause degenerative changes, and even after years cyclitis may arise and cause sympathetic disturbance in the fellow eye.

CASE 6.—H. D., male, white, American, aged 25, while striking with a chisel on some metal was struck in the left eye with a fragment, which penetrated through a wound in the inner corneoscleral area. He was immediately seen by Dr. Alexander Craig, who abscised the prolapsed iris, dressed the eye and sent him to me for further examination twenty-four hours later.

*Condition of the Eye.*—There was a ragged cut in the corneo-scleral region, at the inner side, the lens was cataractous and the anterior chamber half full of blood. Vision was reduced to hand movements above and to the outer side.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination March 29, 1900. Foreign body is situated 12 mm. back of the center of the cornea, 10 mm. below the horizontal plane, and 3 mm. to the nasal side of the vertical plane. Fig. IV.

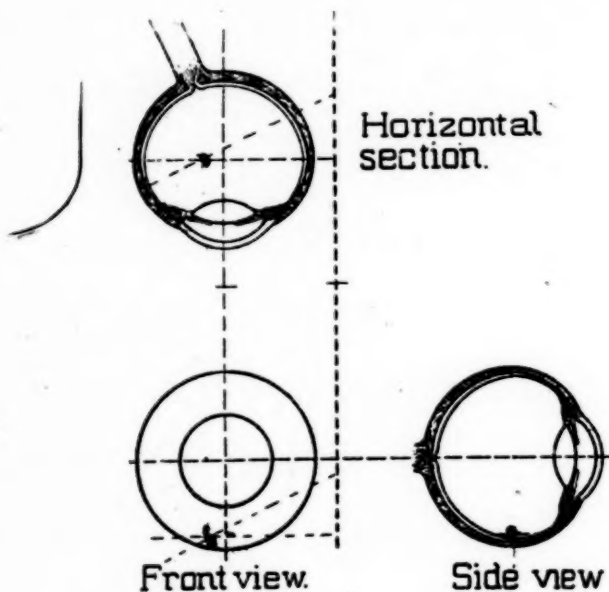


Fig. IV.

*Operation.*—The extension point of a Hirschberg magnet was introduced through a scleral incision placed according to the localization and the foreign body immediately withdrawn. The wound was closed with two stitches passing through the conjunctiva and sclera, and the usual treatment instituted. The healing was uninterruptedly normal, and the patient re-

turned to his home on the eighth day after operation. The foreign body weighed .127 grams, or 1.96 grains.

*Remarks.*—This patient was examined three years later. The eye had been perfectly quiet, and exhibited the appearance of a traumatic cataract and inward iridectomy. Vision equalled hand movements on the temporal side. Although a red reflex was visible through the partly absorbed lens, no details of the fundus were evident.

CASE 7.—H. K., male, white, American, aged 33, while striking with a hammer on some metal, received an injury of

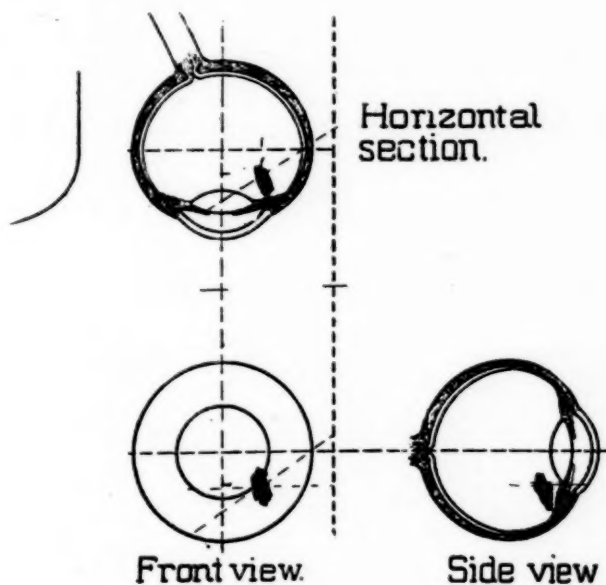


Fig. V.

the left eye, causing a wound of large size near the corneo-scleral junction. He reported twenty-four hours later at the Jefferson College hospital.

*Condition of the Eye.*—The iris was discolored, the eyeball collapsed, and the vitreous and anterior chamber filled with blood; T. — 2, V. doubtful light peception.

*Method of Localization.*—The patient was referred to

Dr. Sweet for skiagraphic examination, who reported as follows:

Examination October 21, 1900. The foreign body is situated 9 mm. back of the center of the cornea; 4 mm. below the horizontal plane, and 5 mm. to the temporal side of the vertical plane. (Fig. V.)

*Operation.*—The extension point of a Hirschberg magnet was introduced through the original wound and immediately a piece of steel withdrawn. The collapsed eyeball was filled with normal salt solution. The eye healed, but when the patient left the hospital, eight days later, it was still somewhat irritable, without view of the fundus. Two months later the evidence of contraction due to proliferating retinitis were present, the eye was painful, and it was enucleated. The piece of steel weighed 27 ctgs.

CASE 8.—J. W., male, white, American, aged 50, while striking with a sledgehammer on a piece of metal, was injured in the right eye. A few hours later an effort was made by the local surgeon to remove a foreign body, but this operation proved unsuccessful and he was referred to me for examination. He reported three days after the injury.

*Condition of the Eye.*—There was a complete ring abscess of the cornea, iritis and hypopyon, and deep in the angle of the anterior chamber, upward and outward, a small piece of metal could be seen.

*Method of Localization.*—As the foreign body was evident to inspection, no other method of localization was employed.

*Operation.*—The angle of the anterior chamber was opened with a keratome, a small piece of the iris excised, and the foreign body, deeply imbedded in the angle and ciliary region, removed. The anterior chamber was washed out with normal salt solution, and the usual treatment instituted. Unfortunately, the metal was lost and its weight cannot be given. Five days later the patient returned to the local surgeon, with the eye still much inflamed and the abscess of the cornea not yet resolved. Four months later he returned, and as the eye had shrunken and was useless, it was enucleated.

CASE 9.—T. McE., male, white, Irish, aged 33, while hammering upon some metal, was injured in the right eye, and reported for treatment about twenty-four hours later at the Jefferson College Hospital.

*Condition of the Eye.*—There was a large ragged wound through the cornea, the eye was filled with blood and vision reduced to light perception.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

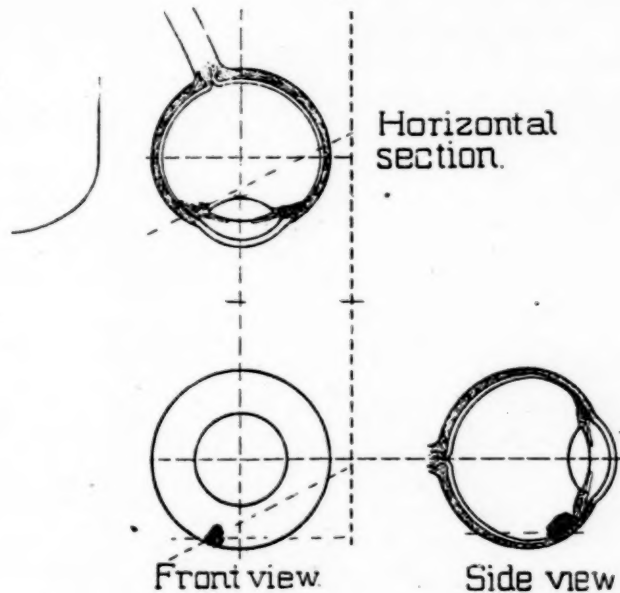


Fig. VI.

Examination April 5, 1901. The foreign body is situated 7 mm. back of the center of the cornea, 10 mm. below the horizontal plane, and 4 mm. to the nasal side of the vertical plane. (Fig. VI.)

*Operation.*—The extension point of a Hirschberg magnet was introduced through the original wound, and the foreign body immediately withdrawn. The usual treatment was in-

stituted, but in spite of it recurring intraocular haemorrhages with great pain continued. The patient became dissatisfied and left the hospital without permission and had his eye enucleated at another hospital. The weight of the foreign body was .1616 grams, or 2.495 grains.

*Remarks.*—It is very evident that this large foreign body had seriously injured some of the vessels of the choroid, perhaps the retina, and that the continued intraocular haemor-

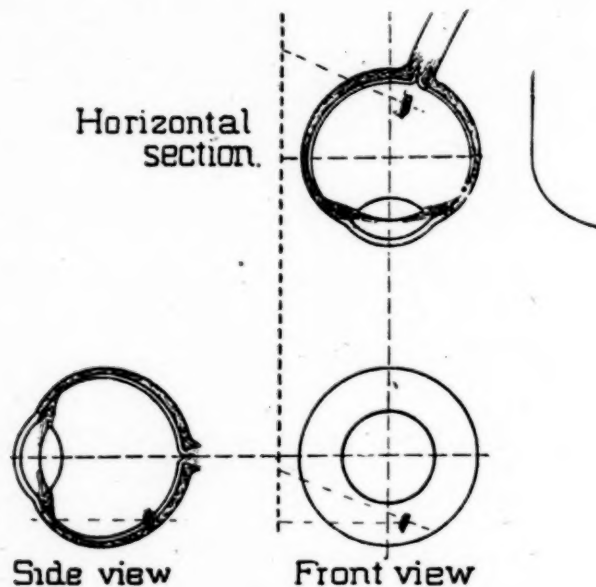


Fig. VII.

rhages were a consequence of this injury. Whether the eye would have quieted had the patient remained at the hospital is a matter of conjecture, but probably the original wound was sufficiently great, added to the intraocular haemorrhages, to have rendered, even had the patient remained under treatment, ultimate recovery hopeless.

CASE 10.—J. H., male, white, Irish, aged 38, while driving a steel pin, inserted in a clay mould, was struck in the right eye with a foreign substance. At the time of the ex-

amination it was uncertain whether this substance was steel or clay. He reported within twenty-four hours of the accident, and was admitted to the Jefferson College Hospital.

*Condition of the Eye.*—There was general bulbar injection and ciliary tenderness, together with a few spots of blood upon the iris. The lens was cataractous and swollen, and on its inner side there was a white spot more opaque than the rest, but close inspection failed to reveal any definite wound of entrance.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination May 16, 1901. The foreign body is situated 19 mm. back of the center of the cornea, 9 mm. below the horizontal plane, and 2 mm. to the nasal side of the vertical plane. (Fig. VII.)

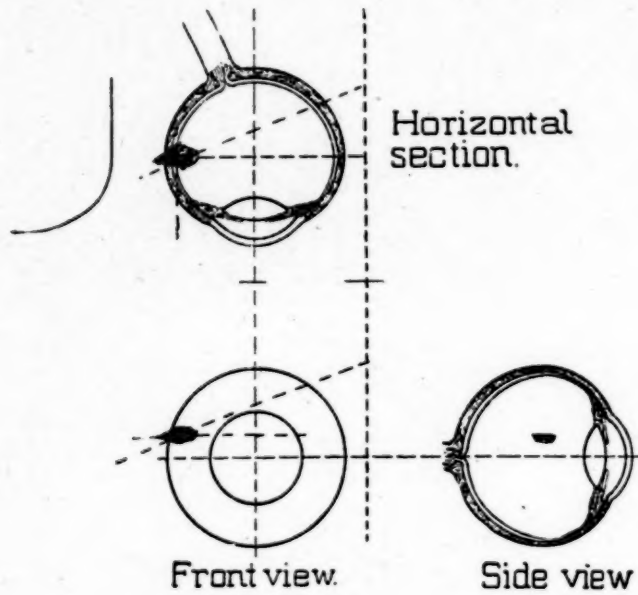
*Operation.*—The point of a Hirschberg magnet was introduced through a small scleral incision made in the region indicated by the localization as the position at which the foreign would be found, and this was immediately withdrawn and found to be a piece of steel weighing .0117 grams, or .18 grains. The patient was put to bed with the usual treatment and eight days later the swollen lens evacuated by linear extraction. Healing was uninterrupted, and six weeks later, with suitable glasses, V. = 6/5, the eyeground being normal.

CASE 11.—J. H., male, white, American, aged 35, while driving a spike, was injured in the left eye, producing a cut in the cornea-scleral region on the inner side, through which the iris was prolapsed. He was seen by a local surgeon, who excised the iris, but who seems not to have suspected the retained foreign body. One week later the patient reported at the Jefferson College Hospital.

*Condition of the Eye.*—There was well-marked iridocyclitis with discoloration of the iris, and the lens was cataractous. The inner half of the iris had been removed, as before stated.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination March 7, 1902. The size of the body is  $6 \times 4$  mm. It is situated 3 mm. above the horizontal plane at



VIII.

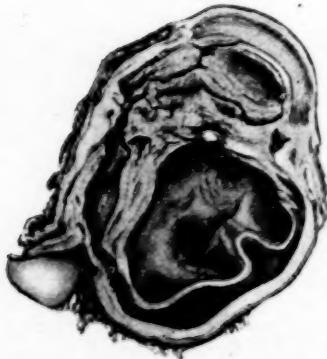


Fig. IX.

Gross appearance of the divided eyeball, Case 11.

the equator on the nasal side of the globe, one end probably cutting through the sclera. (Fig. VIII.)

*Operation.*—With a Hirschberg magnet, the point of which was introduced through a scleral wound at the inner side, a large piece of steel, which unfortunately has been lost and the weight of which is, therefore, unknown, was removed. The patient did extremely well for a time, but left

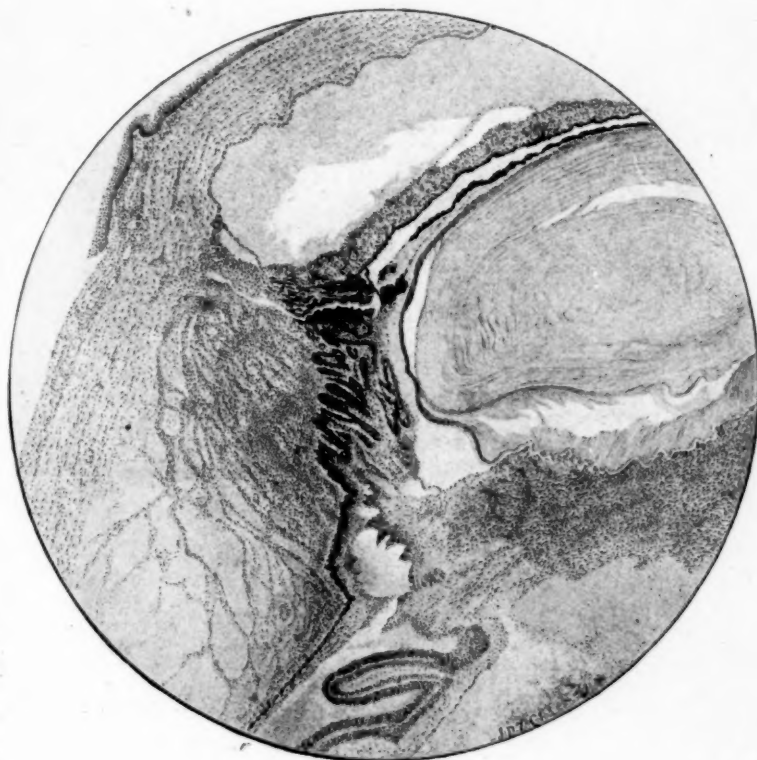


Fig. X.

Microscopic appearance of the divided eyeball, Case 11.

the hospital within a week after the operation against advice, exposed himself to a snow storm, and returned one month later with great increase of the iridocyclitis and beginning in-drawing of the scar of operation. Slight signs of sympathetic irritation in the opposite eye were evident and the injured organ was removed. The enucleated eye, after hardening in

formalin, was divided in equatorial section, and half submitted to microscopic examination and the other half mounted in glycerin-jelly. (Fig. IX.)

*Pathological Examination of the Enuclated Eye.*—

The anterior chamber filled with exudate, and there is a wound evident just posterior to the ciliary region, with indrawn edges filled with scar-tissue. The cornea is distorted at this point and wrinkled, the retina is detached, the choroid shows haemorrhagic extravasations. Posterior to the lens there is a large mass of exudate. Microscopically the conditions are illustrated in the accompanying drawing. (Fig. X.)

The cornea is wrinkled and filled with cells, the iris infiltrated with cells, the ciliary body detached, and like the iris, shows an infiltration of large numbers of round cells, chiefly mononuclear in form and distributed in places in dense masses and in other places along the vessels. A mass of organized exudate exist behind the lens, into which the ciliary processes are drawn, with proliferation of their lining cells. The lens is cataractous and partly absorbed. The choroidal vessels are widely distended and filled with blood, which contain many polymorphonuclear cells. The vessels are surrounded by round cells. The retina is detached, there is a subretinal exudate, and in the retina are numerous round cells and some perivasculitis, while the retinal vessels contain polymorphonuclear cells. The retinal tissue itself is degenerated and oedematous.

*Remarks.*—From the pathological appearances just described it will be seen that they represent those which are typically concerned in the production of the so-called sympathetic inflammation, and indicate the fact that late extraction of the foreign body, after cyclitis is established, may often be unsuccessful to prevent the lesions which may eventuate in sympathetic disease, and illustrate forcibly the importance of early extraction of these foreign bodies.

CASE 12.—T. J. F., male, white, American, aged 35, while working with a lathe was struck in the left eye, and presented himself within two hours after the accident at the Jefferson College Hospital.

*Condition of the Eye.*—There was a small cut at the in-

ner ciliary region, and the anterior chamber and the vitreous so streaked with blood that ophthalmoscopic examination was impossible. Vision was reduced to counting fingers.

*Method of Localization.*—The patient was referred to Dr. Sweet for localization of the foreign body with the X-rays, but as the skiagram showed the presence of the foreign body, and as the case was entirely fresh, it did not seem worth while to wait for the exact plotting of the position of the body, and the eye was immediately submitted to operation.

*Operation.*—The original scleral incision was slightly enlarged, and with a Hirschberg magnet a small foreign body immediately withdrawn. This unfortunately has been lost and its weight cannot be given. Healing was prompt and uninterrupted, and after the absorption of the vitreous clots, aided by the administration of iodide of sodium and hot compresses, vision, after the correction of an existing myopia, was 6/6.

*Remarks.*—This is an excellent example of the importance of seeing patients with retained foreign bodies before infection of the wound or secondary inflammation of surrounding structures take place, and before the body has remained long enough to become surrounded by exudate. At the present time it would be impossible to tell that this patient has ever had an operation performed upon his eye for the removal of a foreign body.

CASE 13.—A. M., male, white, Italian, aged 30, five weeks before reporting for examination, while working with some metal, was struck in the right eye. Two days later he was examined by a local surgeon, who was unable to detect the presence of a foreign body, and who treated the eye expectantly.

*Condition of the Eye.*—Without dilatation of the pupil a few spots of opacity were found in the lens, and down and out in the retina a large haemorrhage in the neighborhood of the point of entrance of the foreign body, which existed as a wound downward and outward in the sclera. Elsewhere the retina was detached and the vitreous filled with floating opacities. The left eye was normal in all

respects. The patient was admitted to the University Hospital for treatment.

*Method of Localization.*—The patient was referred to Dr. Sweet for localization, who reported as follows:

Examination September 1, 1902. The foreign body is situated 15 mm. back of the center of the cornea, 4 mm. below the horizontal plane, and 6 mm. to the temporal side of the vertical plane. Fig. XI.

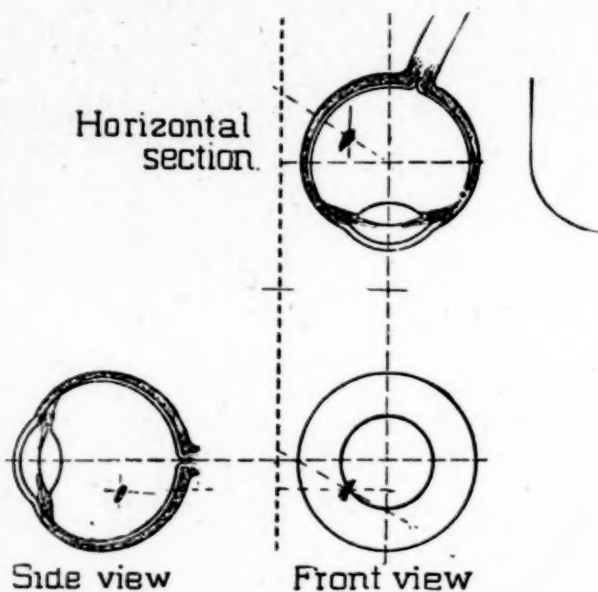


Fig. XI.

*Operation.*—A small incision was made with a Graefe cataract knife, about the width of the blade, over the region which the skiagram indicated as the probable position of the foreign body. The point of the magnet was not introduced within the wound, but only placed at its lips. Immediately the foreign body became attached to the magnet point. It weighed .0836 grams, or 1.29 grains. The patient was put to bed and the usual treatment instituted, healing being uninterrupted. At the end of two weeks the eye was white and

quiet, the retinal detachment unchanged, a slight increase in the lenticular opacity, and vision amounting to counting fingers excentrically.

CASE 14.—W. B., male, white, American, aged 20, while using a chisel, was struck with a flying bit of metal in the right eye, two months prior to his appearance for treatment. He was examined at the time, but a foreign body either not suspected or not found.

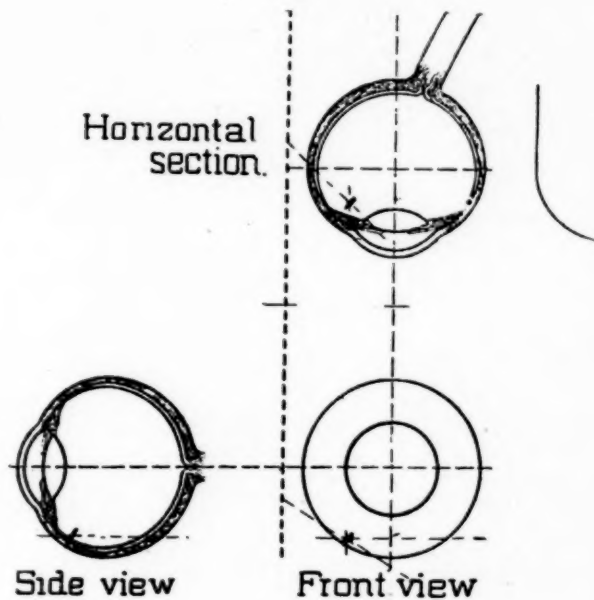


Fig. XII.

*Condition of the Eye.*—The iris was slightly discolored, there was a small scar representing the cut in the cornea upward and inward, and the lens was opaque. Vision equalled light perception, good in all proportions of the field.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination September 6, 1902. The foreign body is thin  $2 \times 1\frac{1}{2}$  mm. It is situated 8 mm. back of the center of

the cornea, 9 mm. below the horizontal plane, and 6 mm. to the nasal side. Fig. XII.

*Operation.*—The body was removed through a small incision in the sclera, placed according to the localization, with a Sweet's magnet, which was approached to the lips of the wound but not introduced. The body weighed .0058 grams, or .09 grains. Three months later the cataract was extracted in the usual manner, without iridectomy. Healing was normal, and, with a suitable cataract glass, vision was 6/5.

CASE 15.—T. S., male, white, American, aged 25, reported at the University Hospital with the statement that six months before he had received an injury while working at his trade, that of a foundryman, but whether a foreign body had penetrated his eye or not he could not say.

*Condition of the Eye.*—Vision amounted to 6/60. There was a good deal of haze in the retina, and in the outer part below the macular region a mass of yellowish-white exudate containing a small black speck near its center could be seen, which probably represented a foreign body, and which undoubtedly was demonstrated to be a metallic body, because the point of a Sweet magnet applied to the sclera over the region named at once caused a sharp pain and the eye became attached to the magnet.

*Method of Localization.*—In addition to the demonstration just recited, as a matter of interest he was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination October 2, 1902. The size of the body is  $2 \times \frac{1}{2} \times \frac{1}{2}$  mm. It is situated 13 mm. back of the center of cornea, 10 mm. below the horizontal plane, and 5 mm. to the temporalside of the vertical plane. Fig. XIII.

*Operation.*—A small incision was made in the usual manner through the sclera, between the insertion of the inferior and external rectus and the point of the magnet applied, without, however, securing the foreign body. The point of the magnet was then introduced within the vitreous cavity three times, but unsuccessfully in so far as bringing to light the foreign body was concerned. The eye healed uninterruptedly and although there was a well marked retino-chor-

oiditis for some time, this gradually subsided and vision equal to that at his original visit and somewhat better is maintained at the present time. Numerous skiagraphic examinations made since have failed to reveal the slightest trace of foreign body, nor has any examination with the magnet indicated its presence. It may, therefore, be assumed that the body

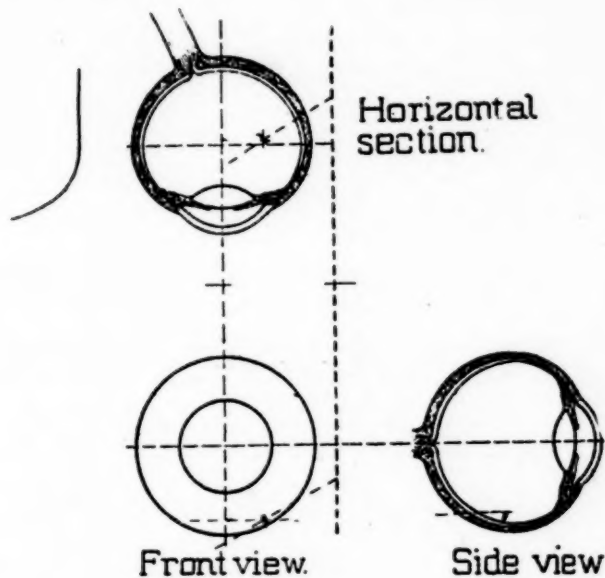


Fig. XIII.

was very small and in some manner escaped detection during the operation.

CASE 16.—J. B., male, white, American, aged 48, while working in a blacksmith shop, received an injury in the right eye, and submitted his eye to domestic medication, poultices and the like, reporting at the University Hospital two days after the injury, sent there by Dr. Craig, of Columbia.

*Condition of the Eye.*—There was a cut through the center of the cornea, the lens was opaque, the iris discolored, and there was a good-sized hypopyon at the bottom of the chamber.

*Method of Localization.*—The patient was not submitted to any method of localization, as it was determined to try and draw the body into the anterior chamber, should it exist in the eye.

*Operation.*—The point of a Sweet magnet was placed directly opposite the cornea, the current turned on, and almost immediately the foreign body appeared in the anterior chamber and was removed through the original corneal wound, slightly enlarged for that purpose. It weighed .0065 grams, or .1 grain. The chamber was washed out with physiological salt solution, and on two occasions packed with iodoform rods. At the second dressing the remains of the opaque crystalline lens were removed through the corneal incision and the rods again introduced. Healing took place slowly, and the iodoform treatment was successful in checking the spread of the infection, and the ultimate result was a sightless globe, with slight anterior phthisis, but to the patient this was a far more satisfactory result than an enucleation.

CASE 17.—W. D. G., male, white, American, aged 19, reported for examination at the University Hospital with traumatic cataract of the left eye.

*Condition of the Eye.*—The eye presented the ordinary appearances of traumatic cataract, with perfectly mobile iris and absence of ciliary irritation; light projection good in all portions of the field.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported that there was a minute foreign body 5 mm. back of center of cornea, 3 mm. below the horizontal plane, and 1.5 mm. to temporal side of vertical plane, that is, in the lens. Fig. XIV.

*Operation.*—The lens was removed by the ordinary method, without iridectomy, and the point of the magnet applied to the lips of the cataract wound. The presence of the body on the end of its extension point after the current had been turned on was not demonstrated. Healing was uninterrupted, and a suitable cataract glass gave the patient a vision of 6/6.

CASE 18.—J. J., male, white, American, aged 27, was injured with a small piece of flying metal in the right eye,

and presented himself about thirty-six hours later at the University hospital.

*Condition of the Eye.*—The eyeball was already infected, the ragged corneal wound being infiltrated, while purulent material was seen at the anterior chamber and the iris inflamed and thickened.

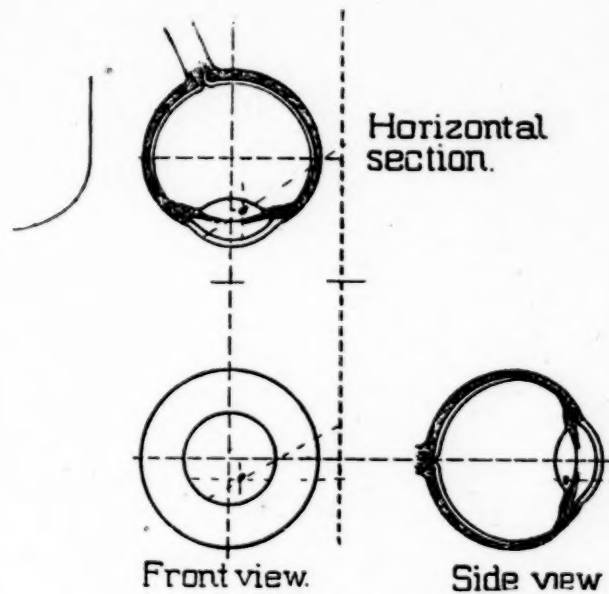


Fig. XIV.

*Method of Localization.*—The X-rays were not used to localize the body, but its presence was immediately detected with the magnet.

*Operation.*—With the Sweet magnet the foreign body was drawn into the anterior chamber and removed through the original wound. The chamber was washed out with normal salt solution and packed with iodoform rods. These, however, failed to check the extension of the suppuration, and after forty-eight hours of treatment, panophthalmitis being very evident, evisceration was performed. The foreign body unfortunately was lost and its weight cannot be given.

CASE 19.—J. S., male, white, Irish, aged 36, several months prior to his application for treatment, was spiking ties on a railroad and was struck with something in the right eye. He did not at the time know whether the fragment which struck him was a particle of metal or a bit of stone.

*Condition of the Eye.*—The eye presented the typical appearance of siderosis bulbi, the iris being of a rust-brown

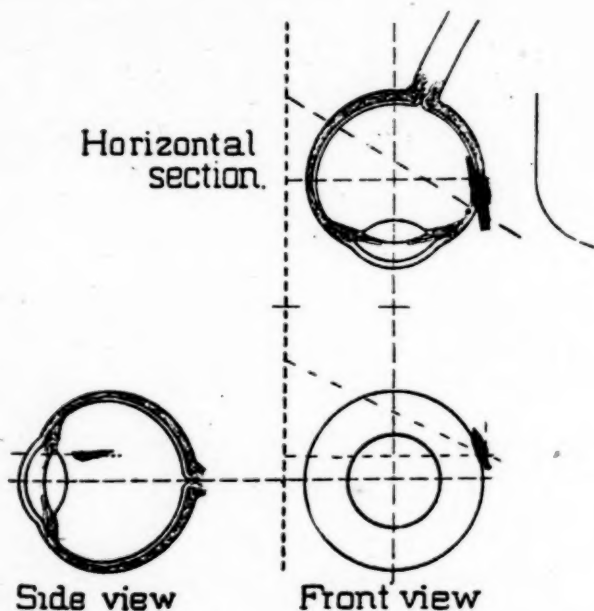


Fig. XV.

color, the lens cataractous and the vision faint light perception.

*Method of Localization.*—The patient was referred to Dr. Sweet for skiagraphic examination, who reported as follows:

Examination March 26, 1903. There is a foreign body 1.5 mm.  $\times$  4 mm. situated above the internal rectus tendon, partly in the sclera. Fig. XV.

*Operation.*—The conjunctiva was incised just above the insertion of the internal rectus muscle and the point of a

Sweet magnet applied to the incision. Almost at once there was drawn to the surface the end of what appeared to be a large piece of metal. It was, however, so tightly imbedded in the scleral tissue and partly within the eyeball itself that it was necessary before it could be extracted to make a small incision along its side through the sclera, when it was at once removed from its surroundings and proved to be a piece of metal  $1\frac{1}{2}$  cm. in length and 4 mm. in width, pointed at one end like an arrow. Its weight was .0982 grams, or 1.515 grains. The patient made an uninterrupted recovery, and left the hospital in forty-eight hours.

CASE 20.—W. Z., male, white, American, aged 61, presented himself at the University Hospital with the history that about twenty-four hours previously, while hammering on a nail, he was struck in the left eye with what was supposed to be a piece of metal.

*Condition of the Eye.*—There was a cut in the center of the cornea, slightly ragged and diagonal, the anterior chamber partly filled with blood and the lens already becoming cataractous. Vision was light perception.

*Method of Localization.*—The X-rays were not employed for the purpose of localization, but the body was detected by means of the magnet.

*Operation.*—The point of a Sweet magnet was applied to the center of the cornea, and almost immediately the foreign body appeared between the edge of the iris and the surface of the lens, and was drawn into the anterior chamber and extracted without difficulty through the wound. Immediately following the extraction there was a sharp haemorrhage, filling the anterior chamber and evidently filling also the vitreous, as the tension of the eyeball rose rapidly and the pain became intense. Under the use of hot compression and hypodermics of morphia this pain gradually subsided, and although on two occasions there was renewal of the haemorrhage, associated with marked chemosis of the bulbar conjunctiva, there was no suppuration, and gradually the reaction subsided and the eyeball became quiet with the ordinary appearances of phthisis bulbi. The foreign body weighed .0065 grams, or .1 grains.

CASE 21.—J. Jeffries, male, white, American, aged 15, while working in a cooper's shop and hammering upon an iron hoop, sustained an injury of the left eye, and presented himself within the first twenty-four hours at the University Hospital.

*Condition of the Eye.*—There was a small cut in the center of the cornea and the lens swollen and cataractous. Vision was light perception.

*Method of Localization.*—The patient was not submitted to X-ray examination, but the body diagnosed by means of the magnet.

*Operation.*—In the usual manner with the Sweet magnet the body was drawn into the anterior chamber, and came from a position just posterior to the lens in the anterior layers of the vitreous, and was removed through the original wound in the cornea from the anterior chamber. The patient made an uninterrupted recovery, and there was a natural absorption of the traumatic cataract, very much as after a dissection, with a vision of 6/15. The foreign body weighed 0.0162 grams, or 0.25 grains.

CASE 22.—A. F., male, white, American, aged 48, while cutting stone with a steel chisel, was injured in the right eye, the foreign body penetrating through the cornea and passing apparently into the upper ciliary region. He was referred to the University Hospital by Dr. Schum, and reported about 48 hours after the injury.

*Condition of the Eye.*—There was general bulbar injection, a wound in the upper corneo-scleral region and a cataractous lens. A slight ciliary flush indicated the beginning of iritis.

*Method of Localization.*—The patient was referred to Dr. Pancoast of the University Hospital for X-ray examination, who reported that the foreign body was situated posterior to the lens in the upper ciliary region.

*Operation.*—A small incision in the sclera over the region indicated by the localization was made and to it was applied the tip of a Sweet magnet. Immediately the foreign body was withdrawn, which measured  $2\frac{1}{2}$  mm. in length.  $1\frac{1}{2}$  mm. in width and weighed .0246 grams, or .38 grains. The healing was uninterrupted, and the patient returned to

his physician with a useful eye, the lens of which, however, was cataractous, vision being light perception in all portions of the field.

CASE 23.—F. C., male, white, French, aged 31, while working in a machine shop, was injured by a piece of flying metal striking him in the left eye, and presented himself within twelve hours after the accident at the University Hospital. An irregular cut in the center of the cornea, traumatic cataract, and haemorrhage into the anterior chamber were evident.

*Method of Localization.*—The eye was not submitted to X-ray examination, but the body was localized by means of the magnet.

*Operation.*—The operation was performed by Dr. Mellor, who, by means of a Sweet magnet, drew the body, which had been situated, apparently, at a position posterior to the lens, into the anterior chamber and extracted it through the original wound. There was for some time afterwards a sharp traumatic iritis, which gradually subsided, and at the present time the eye is perfectly white and quiet, with good light perception in all portions of the field.

CASE 24.—J. D., male, white, Irish, aged 22, came to the University Hospital with the history that two days previously, while working in a cellar where there were some old boxes, he had been injured with a bit of metal which flew either from the head of the hammer, or from some of the iron bands upon which he was striking.

*Condition of the Eye.*—The eye showed well-marked beginning panophthalmitis, the conjunctiva being chemotic, the cornea containing a ring-like infiltration, the iris thickened and purulent.

*Method of Localization.*—The eye was not submitted to X-ray examination as it was hopelessly infected, but immediately examined with the magnet.

*Operation.*—After the foreign body had been drawn into the anterior chamber and extracted, the eyeball was eviscerated and the vitreous found thickly infiltrated with purulent material. Examination of this purulent material showed in addition to a streptococcus infection a marked growth of

the bacillus subtilis. The body weighed .023 grams, or .355 grains.

CASE 25.—A. H, male, white, American, aged 18, while working in a machine shop, was struck in the right eye with a bit of flying metal, and presented himself within twelve hours at the University Hospital.

*Condition of the Eye.*—There was a small cut near the corneo-scleral margin and the foreign body seen in the anterior chamber in contact with the iris.

*Method of Localization.*—No method of localization was required as the body was visible. The operation was performed by Dr. Mellor, who after making a small incision after the manner of that which is utilized in the performance of iridectomy, extracted the body with a small hand magnet. Healing was uninterrupted and the vision normal when the eye had become quiet,

CASE 26.—John G., male, white, American, aged 19, while working in a wire factory three weeks prior to his examination, was struck with a bit of metal which flew either from the hammer he was using or from the wire upon which he was striking.

*Condition of the Eye.*—The closest inspection failed to reveal any point of entrance of the foreign body, indeed, it was believed that there was no foreign body present. The iris was mobile, the eye in good condition and the vision 6/5. Examination with the dilated pupil showed in the upper and inner portion of the eyeground, 3 disc's diameter from the edge of the papilla above the macular region, a metallic body suspended by two delicate, thread-like strings from a circular white exudate. The exudate was surrounded by an area of choroiditis. The foreign body suspended thus in the vitreous could easily be seen with + 8 D. The appearances are depicted in the accompanying water color. (Fig. XVI.)

*Method of Localization.*—The method of localization was by direct inspection with the ophthalmoscope in the manner already described.

*Operation.*—The foreign body was readily removed through a small incision in the sclera placed slightly posterior to the ciliary body and midway between the internal and superior rectus, the point of a Sweet magnet being applied to the lips

of the wound, but not inserted into the vitreous. The body weighed .02 grains.

*General Remarks.*—Coming to a more intimate analysis of the material reported, we observe that in the 26 cases the right eye was injured 14 times and the left eye 12 times. The situation of these foreign bodies in general terms may be stated to have been as follows:

In the anterior chamber	-	-	1
In the lens	-	-	1
In the ciliary region	-	-	6
At or near the equator	-	-	9
In the posterior part of the eye	-	-	9

The ultimate visual result in these cases was as follows: 6/60, 1; 6/15, 2; 6/9, 1; 6/6, 6; counting fingers, 1; light perception with preservation of shape of eyeball, 5; phthisis bulbi, 2; enucleation or evisceration, 8.

Referring to the successes, that is, to those patients who after the operation had a vision of 6/60 or better, we find that the body was situated in the anterior chamber once, in the lens once, in the ciliary region three times, near the equator once, and in the posterior portion of the eye four times. One of the cases, which originally had a vision of 6/15, was seen later, about two months after the operation, and hyalitis had supervened and retinal detachment occurred. The patients who retained the normal configuration of the ball with a vision, either of light perception or counting fingers, could probably in all instances have had their visual acuity improved by extraction of a cataractous lens, but in no instance was this operation performed, and in some cases although advised it was not permitted. Of the two cases of phthisis bulbi, one was caused by successive intraocular haemorrhages, and the other came to the hospital with an infected cornea and iris, and the eyeball was saved after the extraction of the foreign body by Haab's method of placing iodoform rods within the anterior chamber, a method, however, which failed in another similar but more infected case.

Enucleation or evisceration was necessary in eight of the cases, either as an immediate procedure, or sometime after the removal of the body, in order to relieve the pain of an irritable stump, or to prevent sympathetic irritation. In al

of these cases the patients came under observation either after the body had been long situated within the ocular coats, in one instance for eighteen years, or when marked iridocyclitis or infection of the eyeball was already apparent.

Reverting to the length of time the body had existed in the eye before it was removed with the magnet, we have the following results:

Two hours, 1; three hours, 1; twelve hours, 1; one day, 7; two days, 6; three days, 1; seven days, 1; twelve days, 1; three weeks, 1; five weeks, 1; two months, 1; six months, 2; eight months, 1; eighteen years, 1.

It need hardly be pointed out that the length of time quoted is only approximately correct, for example, some of the cases which are noted as having come for treatment at the end of twenty-four hours may have come twenty-two or twenty-three hours exactly after the accident. It is often very difficult to ascertain from patients minute details of this character.

Counting as successful all those cases in which the eyeball was preserved with a vision of light perception or better, we find that the patient reported within three hours after the accident in 1 case; two in 2 cases; twenty-four hours in 4 cases; two hours in 1 case; five weeks in 1 case; two months in 1 case; six months in 2 cases; eight months in one case; twelve hours in 1 case; three weeks in 1 case.

Therefore, it would seem that the mere length of time the body has resided within the ocular coats need not necessarily influence the ultimate visual result, provided its residence there has not caused inflammation, or that it has not carried with it an infection, and provided that it has not become surrounded with exudate, rendering its removal impossible. Naturally, other things being equal, in the absence of infection, the sooner the body is removed the more likely is the result to be a good one, and yet the most active form of infection may become implanted within a few hours, as, for example, Case 18, and Case 24, and the eye be lost in spite of removal of the body and most vigorous treatment to prevent progression of the infection.

The foreign body was visible in the anterior chamber once, in the angle of the anterior chamber and partially im-

bedded in the ciliary region once, in the posterior portion of the eye through the clear media by means of the ophthalmoscope once, and, therefore, no method of localization other than direct inspection and ophthalmoscopic examination was required in these cases. The body was localized by means of the X-rays 15 times. Thirteen of these examinations were made by Dr. Sweet, one by Dr. Pancoast and one by Dr. Max Stern, and all of the examinations except the one by Dr. Stern, according to the method devised by Dr. Sweet. In each of these instances the body was found exactly in the position indicated by the skiagraphic examination.

In 13 of the 26 operations the extension point of the magnet was introduced into the vitreous. Of these 7 eyes were saved\* and 6 were lost. In one of the "saved" eyes there was later a detachment of the retina. In 6 of the 26 operations the extension point of a Sweet magnet was applied at or near the lips of a suitably placed scleral incision, and all of these eyes were saved.

In 7 of the 26 operations the body was drawn into the anterior chamber. Of these eyes 5 were saved and 2 were lost. Both of the eyes noted as lost were, however, infected when they came under observation and their loss cannot be attributed to the operation. It is interesting to note that there were no failures when the body was drawn through a properly placed small incision in the sclera; but if the 2 eyes already hopelessly infected when they first were examined be excluded from the series of operations in which the body was drawn into the anterior chamber, there were also no losses with this method. The number of operations, however, is too small to permit the formulation of deductions on this point. It would seem to me from my own experience and from my observation of cases operated upon by my colleagues that each eye must be dealt with according to the conditions present when it is first examined. Of this I am persuaded that, if the foreign body can be accurately localized by the Roentgen rays, according to Sweet's method, or any other satisfactory method, and the position of the body be found to be such that a small incision may be made directly

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\*The word "saved" indicates that neither enucleation nor evisceration was required.

over it, or in its immediate neighborhood, through which it is drawn by a magnet—the Sweet model has proved most satisfactory—without the introduction of the instrument into the vitreous, the results are just as good as when the attraction of a giant magnet conducts the body from its place in the posterior part of the eye around the lens into the anterior chamber, from which it is subsequently removed. I am further persuaded that what I may call direct extraction after suitable localization presents no greater danger than the other method, and in many instances a danger not so great. Moreover, the traumatism of the delicate incision in the sclera to which the body proceeds by the shortest route is not greater, and, it seems to me, not so great as that produced by the body when it takes a long route into the anterior chamber, from which it must be removed by incision.

As I have already stated, each case is a separate problem, and if the foreign body, for example, has penetrated the cornea and lens and traumatic cataract already exists, it is, of course, to a certain extent a matter of indifference whether the foreign body in coming forward should wound the already injured lens. Again, careful examination will often reveal that the easiest route through which the body may be attracted by the magnet is the one which has proved to be the pathway of entrance. But under any circumstances the value of accurate localization, whether the giant magnet be used according to the Haab method, or whether an incision be made over the approximate position of the piece of metal, must add to the facility of the technique, and I agree with Dr. Sweet in his various publications on this subject, that localization by means of the X-rays is always an advantage to the patient and to the surgeon.

My own results are as follows: Eyes saved with good vision 38.4; eyes lost 30.8; eyes saved, which probably could have been improved by subsequent operations, 23 per cent.; eyes saved, but the ball somewhat shrunken, that is, phthisis bulbi, 7.7 per cent.

#### NOTICE.

The American Academy of Ophthalmology and Oto-Laryngology will hold its 10th annual meeting at Buffalo, N. Y., **On September 14th, 15th and 16th, (1905 (Thursday, Friday and Saturday),** instead of August 23rd to 25th as previously announced.

Dr. Alvin A. Huber, 212 Franklin St., Buffalo, N. Y., is Chairman of the Committee of Arrangements.